Intelligent phase change energy storage device

Can artificial intelligence be used in phase change material energy storage?
This study provides a comprehensive review of the utilization of artificial intelligence (AI) technology in phase change material (PCM) energy storage. The review primarily focuses on its application in solar thermal utilization systems, electric vehicle/electronic device thermal management systems, and building energy efficiency systems.

Are phase change materials suitable for thermal energy storage?
Phase change materials (PCMs) having a large latent heat during solid-liquid phase transition are promisingfor thermal energy stor-age applications. However,the relatively low thermal conductivity of the majority of promising PCMs (<10 W/(m K)) limits the power density and overall storage efficiency.

Can phase change materials reduce heat dissipation in compact electronic devices?
To address the issue of heat dissipation in compact electronic devices,phase change materials (PCMs) offer a promising solution ,. PCMs can passively absorb large amounts of heatthrough latent thermal energy storage mechanisms,thereby stabilizing device temperatures and mitigating thermal fatigue.

Are organic phase change materials a good thermal storage material?
Good thermal stability: organic phase change materials (PCMs) exhibit favorable thermal stability,enabling them to endure multiple cycles of melting and solidification without undergoing degradation. Cost: some organic PCMs can be expensive compared to traditional thermal storage materials like water.

Can spatiotemporal phase change materials be used for solar thermal fuels?
In a recent issue of Angewandte Chemie,Chen et al. proposed a new concept of spatiotemporal phase change materials with high supercooling to realize long-duration storage and intelligent release of latent heat,inspiring the design of advanced solar thermal fuels.

What is a hybrid storage-harvesting energy system?
They possess a heat storage capacity that is 5 to 14 times greater per unit volume than materials such as water,masonry,or rock that store heat based on their temperature . Several researches have shown that a hybrid storage-harvesting energy system that combines phase change materials and thermoelectric generatorsis an encouraging option.

The development of high-performance phase change fibers (PCFs) represents a significant advance toward achieving intelligent wearable thermal management for humans. ...

The phase change temperature control technology developed from phase change energy storage technology as a new thermal control technology, with high ...

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An array of intelligent wearable devices has been developed and progressively integrated into human daily routines. These devices meet ... During conducting photothermal conversion and thermal energy storage of phase change gels, MXene can effectively capture photons and convert light energy into heat energy due to the localized ...

Phase change materials have been known to improve the performance of energy storage devices by shifting or reducing thermal/electrical loads. While an ideal phase change material is one that undergoes a sharp, reversible phase transition, real phase change materials do not exhibit this behavior and often have one or more non-idealities - glide, ...

Herein, we present a novel erythritol-based composite phase change material (PCM) as a new type of STFs with an outstanding capability to store solar energy as latent ...

Phase change cold storage materials are functional materials that rely on the latent heat of phase change to absorb and store cold energy. They have significant ...

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Energy shortages and rising prices have had a serious impact on economic development. The vigorous development of renewable energy and raw materials to replace biochemical resources can effectively enable the world economy to achieve sustainable development [1], [2], [3].With abundant solar energy reserves, the utilization of solar energy as ...

Abstract Artificial Intelligence (AI) is leading the charge in revolutionizing research methodologies within the field of latent heat storage (LHS) by using phase change materials ...

Dual-encapsulated highly conductive and liquid-free phase change composites enabled by polyurethane/graphite nanoplatelets hybrid networks for efficient energy storage ...

Pumped storage is still the main body of energy storage, but the proportion of about 90% from 2020 to 59.4% by the end of 2023; the cumulative installed capacity of new type of energy storage, which refers to other types of energy storage in addition to pumped storage, is 34.5 GW/74.5 GWh (lithium-ion batteries accounted for more than 94%), and the new ...

To enhance the solar energy utilization efficiency of solar-thermal-electrical conversion devices and prevent the heat loss to the environment at night, an intelligent solar ...

Conventional phase change materials struggle with long-duration thermal energy storage and controllable

latent heat release. In a recent issue of Angewandte Chemie, Chen et al. proposed a new concept of spatiotemporal phase change materials with high supercooling to realize long-duration storage and intelligent release of latent heat, inspiring the design of ...

On the other hand, the heat storage performance is improved through optimizing the phase change heat storage device. The tubular, plate and special shape phase change heat storage devices are summarized. U-shaped tube, Z-shaped tube, W-shaped tube, spiral tube and other different structures of heat exchange pipes can be adopted. Cascade phase ...

The defined spatiotemporal ERY-PAM-PDA (erythritol-polyacrylamide-polydopamine) exhibited excellent solar-thermal conversion ability in the optical region, long ...

The swift advancement of energy storage technology has engendered optimism regarding the effective exploitation of renewable energy and industrial waste heat. By the conclusion of 2021, the collective installed capacity of worldwide energy storage has attained 209.4 GW, exhibiting a year-on-year growth of 9.6 % [7]. Notably, pumped storage ...

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